

DEPARTMENT OF APPLIED MATHEMATICS

UNIVERSITY COLLEGE, UNIVERSITY OF LONDON

DRAPERS' COMPANY RESEARCH
MEMOIRS

STUDIES IN NATIONAL DETERIORATION

VI. A THIRD STUDY OF THE STATISTICS OF PULMONARY
TUBERCULOSIS. THE MORTALITY OF THE TUBER-
CULOUS AND SANATORIUM TREATMENT

BY

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AND

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PREFATORY NOTE

IN issuing this third study of the statistics of Pulmonary Tuberculosis in the Drapers' Company Memoirs, I have three aims in view :

(i) To indicate the extreme importance of collecting data as to the treatment of the tuberculous in a form capable of actuarial reduction.

(ii) To moderate in some slight degree the excessive dogmatism prevalent in one or two quarters with regard to the treatment of the tuberculous.

(iii) To show how in this, as in many other problems of a medico-statistical nature, we lack the comparative data on which alone sound judgements can be based, and are liable to replace scientific certitude by impressions and opinions.

I am glad to say, that owing to the due appreciation of these difficulties by a number of medical men further data, not only as to modern sanatorium treatment, but as to the mortality of the tuberculous in pre-sanatorium days, will shortly be forthcoming, and we may hope for further knowledge to confirm or modify the conclusions of this memoir. As it stands the authors appear to me to have rendered more material available for comparison than I have hitherto met with in discussions upon the value of sanatorium treatment. And the lesson of the memoir must be : Advance, but cautiously and without dogma ; sanatorium treatment is of the nature of a reconnaissance, it is not demonstrably a victory.

KARL PEARSON.

THE MORTALITY OF THE TUBERCULOUS AND SANATORIUM TREATMENT

BY W. PALIN ELDERTON, WITH THE ASSISTANCE OF SIDNEY J. PERRY

I. *Introductory.*

"The whole problem of evolution is a problem in vital statistics—a problem of longevity, of fertility, of health and of disease," and it is as interesting from the scientific as it is important from the practical standpoint to examine the effects of various diseases on the length of life, and consider the results of any treatment that may be adopted by the medical profession for combating a particular disease. Of recent years much has been heard of the sanatorium treatment of tuberculosis, and one is naturally led to investigate how much has been achieved by the work done in this direction. We want to know to what extent the treatment prolongs life and increases working capacity. The latter is difficult to decide, because allowance has to be made for shorter hours of work, change of occupation and greater frequency of holidays, but it is perhaps unnecessary to attempt an investigation in this direction, as it seems clear that if life is prolonged working capacity will be prolonged too. We can therefore confine our attention to the effect of sanatorium treatment on the length of life of the patients, and this can be discussed

- (1) by comparing the mortality among tuberculous patients after treatment with that of the general population, and
- (2) by comparing the mortality among tuberculous patients who undergo sanatorium treatment with the mortality of patients before that treatment was used.

It may seem to some readers that such investigations as these are impracticable, because sanatorium treatment has only been adopted for a few years, and it is therefore impossible to get a sufficient amount of information to make a complete table of mortality. This view is, however, incorrect; mortality can be accurately compared even if we only have a few years' observations, for we can find out how many people were exposed at various ages to risk of death—or "had the chance of dying"—in each year under consideration. From the numbers "exposed to risk" we can work out the number of deaths that would have occurred if the mortality had been the same as that of the general population. If the actual number of deaths exceeds the expected number found by our calculation, it follows that the mortality is heavier than that of the general population. This method is used by

actuaries to determine whether the sum paid in claims by an insurance office in a year or series of years exceeds or falls short of the amount that the office would have expected to pay if the mortality had been the same as that assumed in the valuation of the liabilities of the office.

The second problem can be solved in a similar way to the first, but just as the material relating to sanatorium treatment is scanty so is that relating to pre-sanatorium days. It is therefore better to compare both the sanatorium and pre-sanatorium data with the general population, and then examine the results. If the sanatorium patients show only a slightly heavier mortality than the general population, and the pre-sanatorium patients a much heavier mortality, then we shall know that distinct progress has been made, while if the two results are about the same we shall have to conclude that the treatment has not appreciably improved matters.

II. *Particulars required for Investigation.*

With these preliminary remarks we may now turn to the actual method which we propose should be followed in order to give the statistician the information necessary to enable him to work out the figures that are the essential preliminary to any comparison.

The information is best collected on cards such as that reproduced on p. 5, on which the particulars are inserted by the sanatorium authorities. A white card is supplied for male and a yellow card for female lives, and on the backs of the cards definitions of the terms used are given. The reason for distinguishing between males and females is that mortality depends to some extent on sex. The separation is also useful in the particular case of the tuberculous, because, generally speaking, a woman, at least in the professional classes, is not so often obliged to return to ordinary work as a man, and the after-history of discharged female patients may therefore differ appreciably from that of males.

Taking the particulars on the front of the card in order, it may be mentioned that the *Patient's Name* and the *No. in Register* kept at the sanatorium are required for reference and identification, but names are, of course, treated as confidential information by those working out the statistics. The *type of case* is defined on the back of the card, and the medical authorities fill in the type from their diagnosis of the case when it was admitted. The types mentioned are, we understand, easily distinguishable, and although there must in all such divisions be border-line cases, little difficulty should arise in this connexion.*

Occupation or Class. This is important, as the mortality depends greatly on the occupation, and it would be unfair to compare the results of one treatment

* The classification is that used by Dr. Lawrason Brown at the Adirondack Cottage Sanitarium, N.Y. The "Incipient" class includes Turban Stage I, the "moderately advanced" class includes Turban Stages I, II, and III, but chiefly II, and the "far advanced" class includes Turban Stages I, II, and III, but chiefly III.

on the upper classes with another treatment on those living in the poorer and more crowded districts of large towns, because we already know that the general mortality of the former is much lighter than that of the latter.

Front.

Vital Statistics of Sanatoria Patients.

This card must on no account be destroyed. It must be kept up to date and sent to Professor KARL PEARSON, F.R.S., University College, London, once every five years for actuarial reduction.

Name of Sanatorium.....

Patient's Name.....

No. in Register.....

Type of case*

Occupation or Class.....

Date of Birth.....

Date of admission.....

Date of discharge.....

Condition on discharge*

If dead.—Date of death.....

If lost sight of.—Date when last heard from.....

If living.—Date when last heard from.....

[To be filled in in pencil, and corrected each year.]

Remarks :

* See back for definition of terms.

Date of Birth. When possible this should be given exactly ; but if the age only is known the year should be inserted, and in doing this it should be borne in mind that 25 last birthday means $25\frac{1}{2}$ approximately, and if a person states

Back.

DEFINITION OF TERMS.

I.—TYPE OF CASE ON ADMISSION.

Incipient (favourable).—Slight initial lesion in the form of infiltration limited to the apex or a small part of one lobe. No tuberculous complications. Slight or no constitutional symptoms (particularly including gastric or intestinal disturbances or rapid loss of weight).

Slight or no elevation of temperature or acceleration of pulse at any time during the twenty-four hours, especially after rest.

Expectoration usually small in amount or absent.

Tubercle bacilli may be present or absent.

Moderately advanced.—No marked impairment of function either local or constitutional.

Localized consolidation moderate in extent with little or no evidence of destruction of tissue ;

Or, disseminated fibroid deposits.

No serious complications (tuberculous).

Far advanced.—Marked impairment of function, local and constitutional.

Localized consolidation intense ;

Or, disseminated areas softening ;

Or, serious complications (tuberculous).

II.—CONDITION ON DISCHARGE.

Progressive (unimproved).—All essential symptoms and signs unabated or increased.

Improved.—Constitutional symptoms lessened or entirely absent ; physical signs improved or unchanged ; cough and expectoration with bacilli usually present.

Arrested.—Absence of all constitutional symptoms ; expectoration and bacilli may or may not be present ; physical signs stationary or retrogressive ; the foregoing conditions to have existed for at least two months.

Apparently cured.—All constitutional symptoms and expectoration with bacilli absent for a period of three months ; the physical signs to be those of a healed lesion.

Cured.—All constitutional symptoms and expectoration with bacilli absent for a period of two years under ordinary conditions of life.

on, say, April 14, 1910, that he is 25 last birthday, his year of birth should be given as 1884, and not 1885.

Date of Admission explains itself, and this entry completes all the information that has to be filled in when a patient is admitted. The remainder of the card deals with subsequent history.

Date of Discharge. This explains itself, and is required in cases where an investigation of the mortality after discharge is made instead of or as well as that after admission.

Condition on Discharge. The terms used are explained on the back of the card, and the only remark that it is perhaps necessary to add is that the term "cured" is merely used to describe the upper end of the scale: we quite appreciate that from some points of view we cannot know if a case is really cured.

If dead—Date of Death. This must include deaths in the Sanatorium. If the exact date is not known the year should be given.

If lost sight of—Date when last heard from.

If living—Date when last heard from.

Taking these two items together, we may explain that it is essential that the sanatorium authorities should write to discharged patients, say once a year, or, better still, once in six months. In cases where a patient does not answer it must sometimes be possible to trace a relative, and, failing this, a search through one of the mercantile agencies will often elicit information, or at any rate enable one to ascertain whether the patient is dead.* Each time a patient replies or information is obtained that he is alive, a pencil note is made against "if living", and if a patient does not reply and cannot be traced the date when he was last heard from is entered opposite "if lost sight of".

It may be remarked that no entry has been made for "cause of death", but this can, if desired, be placed against "Remarks". For our present purpose we are not concerned with it, and in many cases it may mislead. What we wish to see is how long after careful treatment the patient lives, and we expect a certain proportion of deaths from miscellaneous causes. Even if it were possible the elimination of such cases would merely complicate matters, and in this connexion we may mention that one objection to dealing only with deaths from the disease from which the patient suffered is that if, for instance, death resulted from a railway accident it would still be possible for the patient to have consumption in an advanced stage, but the cause of death would obscure the fact. Another objection is that the constitution may be weakened as a consequence of the attack of tuberculosis, so that it is less able to resist other diseases—a point which the discussion of deaths from tuberculosis only would probably miss.

* As will be seen from the tables appended to this paper, Bardswell, whose observations extended over six or seven years, only lost sight of 7 people out of 241 admitted.

III. *Treatment of Data.*

When a number of cards is available the method of dealing with them is to insert on the card (1) the age at admission, and if the exact date of birth is given the nearest integral age at entry would be calculated, as this is the best approximation to the exact age, and (2) the duration between the date of admission and the date of death, or the date when last heard from if living or lost sight of. From these facts we can arrange our tables and make our calculations for each age after admission. If we required to trace the patients only after discharge the durations would be calculated from the date of discharge instead of from the date of admission. The reader will notice that all cases must be considered, and not only those who die; the reason is that if a person is admitted at age 20, and after being observed for ten years is still alive, he had, as it were, a chance of dying, or was "exposed to risk" of death in each one of the ten years, and the neglect of his case would artificially increase the rates of mortality and lead to erroneous results.

We can now turn to an investigation which we were enabled to make by the kindness of Dr. Noel D. Bardswell, who supplied us with information as to 241 patients who had been treated by him and of whom particulars of a general character are given in some detail in his recent book.* The particulars related to 241 cases which may be summarized as follows:—

TABLE I.†

Type of case.	Males.	Females.	Total.
Incipient	40	22	62
Moderately advanced	69	25	94
Far advanced . . .	49	36	85
Total	158	83	241

When working out our results from the particulars given we thought it well to keep the three types of cases separately, because it is possible that a treatment may be very successful when the cases are taken at an early stage of the disease and of far less use in other cases. We also decided to consider the cases not only according to the age of the life, but also with regard to the time that had elapsed since admission to the sanatorium, as it is likely that persons admitted at age 30 would immediately after admission be subject to a different rate of mortality from people of the same age admitted, say, five years previously.

Although we had an insufficient number of cases to investigate some of the

* *The Expectation of Life of the Consumptive after Sanatorium Treatment.* Henry Frowde and Hodder & Stoughton, 1910.

† There is a difference of one between this table and that given on p. 11 of Dr. Bardswell's book, but an examination of the cards has not revealed an error.

problems that suggest themselves, we give the results, as they may be convenient for reference in some future investigation.

There were one or two points that arose in the particular investigation which rendered it necessary to make a few preliminary assumptions which it will be well to detail, as they are likely to be necessary in many other similar investigations. In several cases we knew only the year of birth, and we were also without any more exact information as to the date of death. In the circumstances we made the following assumptions, which are near enough to the truth to prevent any error worthy of mention in our results:—

1. Persons admitted in any calendar year were assumed to enter in the middle of that year.

2. Persons lost sight of were assumed to have been lost sight of at the middle of the year in which they were last heard from. As they had been written to annually in January this was, we think, a reasonable assumption.

3. Persons still alive on Jan. 1, 1909, when the investigation closed, were credited with a full year's exposure to risk of death in 1908, but were not deemed to have been at risk for any part of 1909.

A few typical examples will perhaps render this clearer: a person admitted in 1901 and still alive in 1909 was included in our calculation to the extent of half a year in 1901 and the whole of the years 1902 to 1908 inclusive, i.e. $7\frac{1}{2}$ years in all. A person admitted in 1901 and lost sight of in 1906 was considered for half a year in 1901, the whole of the years 1902–5 inclusive, and half 1906, i.e. 5 years in all. A person admitted in 1902 and dying in 1907 was considered for half a year in 1902 and the whole of the years 1903–7 inclusive, i.e. $5\frac{1}{2}$ years in all. A word of explanation is necessary here, as the reader may wonder why we did not assume only 5 years' exposure. The reason is that the rate of mortality is the ratio of the number of persons dying during a year to the number at risk at the beginning of the year, and if we only gave half a year's exposure in the year of death we should therefore obtain a ratio which would not come under this definition and could not be conveniently compared with other known rates of mortality.

It should be mentioned that while the method adopted gives closely approximate results, it is open to one objection when we deal with a small number of cases, namely, if a person is admitted in any year and dies before the end of that year there is half a year's exposure and one death, i.e. the number of deaths exceeds the number exposed to risk. Such anomalies are unavoidable—they are more apparent than real.

The ages were calculated by assuming that the birthdays were in the middle of the calendar year, which is, on the average, correct. If, therefore, the year of birth was 1865 and the year of admission 1901, we assumed that the age at admission was exactly 36 on June 30, 1901. It follows that the age at the end of 1901 was $36\frac{1}{2}$.

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IV. *Results of Mortality Investigation.*

Tables X to XXVII give the information for each year after admission for various ages. The first line in each table refers to the half-year from the assumed date of admission in the middle of the year until the end of that year. As it only relates to half a year the number "exposed to risk" for a full year is one-half of the number entering less one-half of the number lost sight of during that year. The only other column in the tables to which reference need be made is that headed "expected number of deaths". This has been calculated by multiplying the number exposed to risk by the rate of mortality shown by the Registrar-General's English Life Table (No. 6) for the average age of the group, and gives the number that would have died in the year if the persons considered had the same rate of mortality as the general population. Since the patients treated were drawn mainly from the professional classes it would have been preferable, had it been possible, to use the rates of mortality applicable to these classes. This would have reduced the expected number of deaths and Table II is accordingly somewhat too favourable to sanatorium treatment.

The following abstract of the results is of interest :—

TABLE II.

No. of years since Admission.	A. Males.					
	Incipient Cases.		Moderately Advanced Cases.		Far Advanced Cases.	
	Actual No. of deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.
0	—	.141	1	.301	14	.221
1	2	.298	8	.626	17	.346
2	—	.299	7	.575	6	.198
3	—	.311	3	.519	5	.125
4	1	.322	1	.512	1	.092
5	3	.261	1	.399	2	.071
6	1	.166	2	.303	—	.036
7	1	.083	1	.158	—	.026
8	—	.006	—	.031	1	.010
Total	8	1.887	24	3.424	46	1.125

No. of years since Admission.	B. Females.					
	Incipient Cases.		Moderately Advanced Cases.		Far Advanced Cases.	
	Actual No. of deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.
0	—	.069	1	.085	6	.106
1	1	.144	2	.170	10	.196
2	1	.140	2	.166	5	.142
3	—	.145	—	.163	1	.123
4	—	.141	2	.165	3	.123
5	1	.101	3	.128	—	.092
6	—	.049	—	.057	4	.065
7	—	.023	—	.023	—	.024
Total	3	.812	10	.957	29	.871

In each of these summaries the actual number of deaths is considerably in excess of the number that would be expected, and even in the most favourable case the actual number is about four times the expected, while in the worst case the actual number is about forty times the expected. In order to complete the comparison we must, however, make an estimate of the probable errors of the number of deaths, because it is possible that although we expect, say, one death, three might not be very improbable, and the fact that three were found on one occasion might therefore prove nothing. In the present instance it is especially important to go into the question, as we are dealing with a very small number of cases in each group, and we took the "Incipient" cases among female patients, where the mortality was lightest, as a test, and found that the chance of getting three or more deaths out of 114 exposed to risk, if one (strictly .812) was expected, was .047. In other words, the odds were about 20 to 1 against the deviation from the expected number being due merely to chance, while in the next most favourable case the odds were more than 1,000 to 1.

Table XXVIII shows the mortality of all the cases considered, and may be taken as giving an idea of the mortality among the tuberculous from the moment when sanatorium treatment begins.

So far we have dealt only with the mortality after admission, but as an alternative we can subdivide the cases according to the condition of the patient on discharge. The two sets of groupings are useful in helping us to solve different problems; the tabulation according to the condition on admission should ultimately tell us to what extent life is prolonged when the disease is treated in what appear to be its earlier stages, while the tabulation according to condition on discharge tells us what happens to the cases in which the treatment has apparently been wholly or partially successful.

Tables XXIX to XLVI give the mortality after discharge among the "apparently cured", "arrested", and among cases in which the disease is still "active" (i.e. "progressive" and "improved", which were taken together).

The following is a summary of the results :—

TABLE III.

No. of years since discharge.	A. Males.					
	Apparently Cured.		Arrested.		Active.	
	Actual No. of Deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.
0	—	.148	—	.193	11	.283
1	—	.312	4	.403	19	.509
2	—	.327	2	.390	12	.330
3	1	.342	—	.395	2	.195
4	1	.341	1	.391	3	.186
5	1	.267	—	.281	2	.140
6	—	.136	2	.207	1	.072
7	1	.051	1	.090	—	—
Total	4	1.924	10	2.350	50	1.715

No. of years since discharge.	B. Females.					
	Apparently Cured.		Arrested.		Active.	
	Actual No. of Deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.	Actual No. of Deaths.	Expected No. of Deaths.
0	—	.046	—	.052	10	.150
1	—	.096	1	.110	7	.255
2	—	.101	—	.105	5	.227
3	—	.107	1	.111	4	.212
4	—	.098	—	.101	1	.188
5	1	.078	1	.072	3	.160
6	—	.060	—	.023	3	.065
7	—	.012	—	.007	—	.035
Total	1	.598	3	.581	33	1.292

As would naturally be expected, the “apparently cured” cases show a light mortality as compared with the cases in which the disease had only been arrested, and in the case of the female lives the actual number of deaths cannot be said to exceed the expected number by the English Life Table. This may, however, be partly due to the small number of cases available, and if we take the male and female cases together we see that there were 5 deaths as compared with an expected number of 2.522. The odds against the occurrence of 5 deaths being due only to chance are about 8 to 1. Of course these figures need confirmation with fuller statistics, but on the information now available we must conclude that, even in the cases in which the treatment has been most successful, people who have once suffered from tuberculosis experience a heavier rate of mortality afterwards than the general population.

Table XLVII gives the mortality according to age and regardless of the time that has elapsed since discharge, for the cases in which the patient has been discharged with the disease in a quiescent stage (i.e. the apparently cured and arrested cases).

V. *Comparison with similar published material.*

The only other study on similar lines known to us is that described by Dr. Lawrason Brown and the late E. G. Pope,* who were fortunately able to deal with as many as 2,244 cases treated at the Adirondack Cottage Sanitarium, some of which had been under observation for about twenty years. Their statistical method was rather different from ours in some respects, as they grouped males and females together and used the English Life Table (No. 3) with the average age of the patients for finding the expected number of deaths. They considered that, the number of cases being small, it was not worth while to separate the sexes, and they

* Lawrason Brown, M.D., and E. G. Pope: “The Ultimate Test of the Sanatorium Treatment of Pulmonary Tuberculosis and its application to the Results obtained in the Adirondack Cottage Sanitarium,” *Zeitschrift für Tuberkulose*, Bd. xii, S. 206–15, Leipzig, 1908.

state that there were equal numbers of males and females. While it is clear to us that the authors, who are, we believe, pioneers in investigating the after mortality of consumptive patients, satisfied themselves that for their purpose the method they followed was sufficiently accurate, we think it would have been better to have gone into greater detail, if only because a larger number of cases may some day be available, and the subdivided material would then be of greater service for comparison. Other points to be borne in mind in reading Brown and Pope's interesting paper are (1) that the patients were Americans and the general mortality for America differs from that for England; (2) that, as many of the cases considered had been treated several years ago, it is almost certain that patients now admitted to sanatoria undergo a modified treatment; and (3) in examining the tables given in the paper it should be noticed that under the heading "not heard from subsequently" both those "lost sight of" and those "living at the close of the investigation" have been included, so that one is given the impression that Brown and Pope lost sight of more patients than is really the case.

It will also be observed that Brown and Pope only give their cases subdivided according to the condition of the patient on discharge, and even in these cases it is a little difficult to compare with the results obtained from Dr. Bardswell's data, as the ages are not given, but Table IV, p. 13, is, we think, substantially correct. In forming it, we found from the rates of mortality in Table IV of Brown and Pope's paper the age that had been used, and then used the same age with the English Life Table (No. 6). So far as we could tell, a close approximation would be reached by taking an initial age of 28 and assuming an equal number of males and females. The average ages at the later durations were taken as 29, 30, 31, &c., and although this is probably inaccurate at long durations it cannot be far from the truth for the short durations, and in view of the relatively small numbers after a duration of ten years the error introduced is, we think, negligible. We had to use the same average ages for each of the three groups, and the expected number of deaths by the English Life Table (No. 6) and the actual number are given in our Table IV. The reason for the decimals in the actual number of deaths is that some cases died at unknown dates and were distributed by Brown and Pope in the same proportion as the known deaths. We may here explain that we have used the English Life Table (No. 6), not because it is the most suitable for the examination of statistics drawn from an American sanatorium, but because it was the standard we used in Bardswell's cases, and for comparative purposes all tables must, as it were, be reduced to a common standard.

Bardswell's results appear rather more successful than Brown and Pope's, but it must be remembered that some of the patients at Adirondack Sanitarium were first observed twenty-five years ago, and that race and climate make an appreciable difference in mortality investigations.

In the *Bericht über die IV. Versammlung der Tuberkulose-Ärzte* (Berlin, May 24

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and 25, 1907), Dr. Roepke referred to Rumpf's statistics from Friedrichsheim and gave information as to the patients discharged in 1901, showing how many were living at the beginning of 1906, that is after $4\frac{1}{2}$ years. Taking an average age of 30, and using the English Life Table (No. 6), the expected number of deaths per cent. of those discharged and actual number per cent. are as shown in Table V.

TABLE IV.

EXPECTED NO. OF DEATHS BY THE ENGLISH LIFE TABLE (No. 6), AND THE ACTUAL NO. OF DEATHS AMONG PATIENTS DISCHARGED FROM THE ADIRONDACK COTTAGE SANITARIUM (Brown and Pope).

Time after Discharge.	Apparently Cured.		Arrested.		Active.	
	Expected.	Actual.	Expected.	Actual.	Expected.	Actual.
0- 1 years	2.7	9.4	5.0	43.8	4.1	276.9
1- 2 "	2.5	4.7	4.3	68.7	2.4	122.7
2- 3 "	2.4	8.3	3.3	64.0	1.7	50.6
3- 4 "	2.1	7.1	2.6	41.5	1.2	35.4
4- 5 "	1.9	8.2	2.0	33.2	.9	15.2
5- 6 "	1.6	7.1	1.5	11.8	.7	11.4
6- 7 "	1.3	3.5	1.2	10.7	.6	13.9
7- 8 "	1.1	5.9	.8	8.3	.5	2.5
8- 9 "	.8	2.4	.7	2.4	.4	5.0
9-10 "	.7	1.2	.6	3.5	.3	1.2
10-11 "	.5	—	.4	—	.3	6.3
11-12 "	.5	—	.3	3.5	.2	—
12-13 "	.4	1.2	.2	1.2	.2	1.3
13-14 "	.3	—	.2	—	.1	—
14-15 "	.2	—	.1	—	.1	1.3
15-16 "	.1	—	.1	—	.1	—
16-17 "	.1	—	.1	1.2	.0	1.3
17-18 "	.1	—	.0	—	—	—
18-19 "	.1	—	.0	—	—	—
19-20 "	.0	—	.0	1.2	—	—
Total .	19.4	59.0	23.4	295.0	13.8	545.0

TABLE V.

Group.	No. of Cases Discharged.	No. of Deaths per cent. of Discharged Patients.	
		Actual.	Expected.
I	148	8	4
II	146	20	4
III	207	61	4

The grouping* is not the same as that of Table IV, as it refers to the state on admission, not on discharge, and the age we have assumed may be a year or two wrong, but we give the result as it may be of interest. We made a rough trial using the figures given by Roepke for the patients discharged in the years 1901-5, and found that in Group I the deaths were about 1.7 times the expected by the English

* This is probably Turban's grouping, see our footnote, p. 4.

Life Table; but this result must also be taken as an estimate, as Roepke does not give the figures in a form convenient for our present purpose. In a similar way we found that the deaths in Group II were 4.5 times the expected, and in Group III 30 times the expected.

VI. *Comparison of Sanatorium Results with those obtained in Pre-sanatorium Days.*

In order to see whether the sanatorium treatment is efficient one ought to make a comparison of the mortality following that treatment with the mortality that followed the treatment formerly adopted. It is, however, somewhat difficult to obtain statistics, and with the exception of those given by C. T. Williams * and some figures given by J. E. Pollock † we have not succeeded in tracing any that are suitable for comparison.

Those who have followed the method we have adopted in dealing with Bardswell's data will doubtless appreciate that, in order to make a proper comparison between two sets of statistics bearing on mortality, it is essential that

- (1) the statistics should have the same starting-point—i. e. we must not compare statistics reckoned from the date of onset of the disease with statistics reckoned from the date of admission;
- (2) the ages at the dates of onset or admission should be known—not merely the average age (although for approximate work this is better than nothing);
- (3) particulars of *all* cases must be given, not only of deaths.

Perhaps (3) is the most important; it is due to their failure to appreciate its essential importance that the older writers published data which were valueless because they do not give the total number of cases they treated, but only the number who died. Consequently we are unable to work out their figures by a correct process. Let us, however, apply their faulty methods to modern data and see the result (Table VI).

TABLE VI.

Name of Observer.	Duration of Disease in months. Estimated from the Deaths only.
Laënnec	24
Louis and Bayle	23
Andral	24
Clark	36
Pollock	33
Flint	33
Brown and Pope	30
Bardswell	27

* *Pulmonary Consumption*, ch. xxi, or, "On the Duration of Phthisis Pulmonalis and on certain Conditions which influence it," *Med. Chir. Trans.*, 1871, vol. liv, pp. 95 et seq.

† *Elements of Prognosis in Consumption*. Longmans, Green & Co., 1865. See especially pp. 77-9.

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This table does not give a correct comparison even on the method adopted, as the ages of the cases varied with the different sets of observations, while the sanatorium data are reckoned from date of admission, not from date of onset; but the method as indicated above fails, for even if the rates of mortality were doubled we should not appreciably alter the duration of the disease as estimated from deaths only.

Those who have regarded the method by which Table VI was constructed as worthy of use in a serious comparison * may be somewhat surprised at the result, and perhaps be willing to admit that their comparisons have been vitiated by wrong statistical methods.

TABLE VII.

Pollock's Statistics.

Total No. of Cases, 4,507.

Years since Onset of Disease.	No. of Cases living at latest Observation.	Deaths.	Exposed to Risk.	Expected No. of Deaths.
0- 1	1,235	29	2,948.5	19
1- 2	941	26	1,831.5	13
2- 3	512	15	1,079	8
3- 4	297	6	659.5	5
4- 5	183	12	413.5	3
5- 6	95	9	262.5	2
6- 7	54	4	179	2
7- 8	39	—	128.5	1
8- 9	28	2	95	1
9-10	29	—	64.5	1
10-11	5	—	47.5	1
11-12	21	—	34.5	—
12-13	—	—	24	—
13-14	1	—	23.5	—
14-15	13	—	16.5	—
15-16	—	—	10	—
16-17	—	—	10	—
17-18	—	—	10	—
18-19	—	—	10	—
19-20	10	—	5	—
Indefinite	915	26	2,077, say	15, say
Total	4,378	129	9,929.5	71

We may now turn to Pollock's and Williams' statistics, as these afford the only satisfactory basis on which to compare past and present results. In case, however, it should appear to the reader that in using these data we are merely repeating work which has been done by others, we may mention that so far as we are aware

* e. g. Arthur Latham and Chas. H. Garland, "On the Influence of Sanatorium Treatment of Tuberculosis," Letter to *British Medical Journal*, June 25, 1910. See also *The Conquest of Consumption*, by same writers, and figures by Dr. F. C. Shrubsall quoted by Latham in "The Economic Value of Sanatoriums," *Lancet*, January 6, 1906.

the writers who have used Pollock's and Williams' results have adopted statistical methods which are open to serious criticism, while in one paper the analysis of 194 cases classed by Pollock as "chronic phthisis in the first stage" concluded with the statement that 83 per cent. of these cases were dead at the end of the fifth year, whereas not a single case had died.*

With these preliminary remarks we may refer to Pollock's statistics on pp. 77 and 78 of *Prognosis of Consumption*, from which Table VII has been prepared; the figures in the last two columns for the cases of indefinite duration have been obtained by proportion. The expected number of deaths has been calculated by the English Life Table (No. 6), using an average age of 30 for the 0-1 group, and on the assumption that 60 per cent. of the cases were males (see Pollock, p. 72).

It is clear that the cases were not "observed" during the whole periods mentioned by Pollock, as he points out that he estimated as accurately as possible the time the patient had suffered from the disease.† The inclusion of all cases from the date of onset makes the mortality lighter than it should be, and the error from the point of view of comparison with the results already shown in this paper may be described by saying that we really require the duration measured from the date when the case was treated, while Pollock measures it from the date when the disease is estimated to have begun, which may have been several years earlier. The error involved is, however, a little difficult for the non-actuarial reader to appreciate at first sight, but if we take a fairly obvious example it may help to make it clearer. Thus, if Pollock was never consulted until a patient had already been treated by other practitioners for not less than a year, then it is clear that his statistics could show no deaths in the first year of the disease, but this would not prove that there were no deaths; or, again, if Pollock had been connected with a hospital which only took adult cases, his statistics could not show any deaths under age 21 from phthisis, although the first symptoms of some of his cases may have shown themselves long before that age. Following out this line of thought it becomes clear that, as he ascertained that the disease first showed itself some years or months previous to his treatment, and as he recorded the age of the patient at the date of the first symptom instead of at the date when he first treated the case, we shall underestimate the rates of mortality among his patients if we take his figures as they stand. Table VII therefore shows too light a mortality, and it seems possible that many durations of more than a few years were estimates of the

* *Vide* "The Economic Value of Sanatoriums." The mistake, which is repeated on p. 44 of Latham and Garland's *The Conquest of Consumption*, London, 1910, has already been pointed out by Professor Karl Pearson in the *British Medical Journal* for June 18, 1910. In the same journal for June 25, 1910, a reply appeared, but it contained the errors to which reference has already been made.

† *Vide* Pollock, p. 78: "... the greatest care was taken to ascertain the exact commencement of the disease."

time before treatment during which symptoms were present. As a rough estimate we assumed that a year was the maximum time of observation, and then found that the expected number of deaths was 24, and the actual (129) is $5\frac{1}{2}$ times as large. This is a rough estimate, and Pollock's results may have been and, we think, were, far better than is implied, as he certainly observed some cases for several years.

The other useful statistics relating to the mortality of consumptives in pre-sanatorium days are those given by Williams, and these are more satisfactory than Pollock's because efforts were made to keep in touch with patients after they had ceased to be treated, and the Clergy List, Army and Navy Lists, &c., were examined with this end in view.

Williams gives particulars of 1,000 cases, of which 625 were males and 375 females, the former having an average age at onset of $29\frac{1}{2}$ and the latter an average age of 26. The cases were selected because they had been at least a year under observation, but on p. 98 of the paper in the *Medico-Chirurgical Transactions*, in order to show what happened in the first year he investigated 433 cases which had first been seen by his father, Dr. Williams, Senior, in 1863, and of these 245 were seen only once and no more was heard of them; 84 were one year and upwards under observation and were included in the 1,000 cases investigated. Of the 104 remaining, 8 died, 13 were rather worse, 3 about the same, 75 improved, and 5 quite restored to health. The "exposed to risk" would have been approximately 140, the expected number of deaths 1, and the actual number was 8. This result would not compare unfavourably with that given by Brown and Pope's or Bardswell's data if Williams had a fair proportion of advanced cases.

Returning to the 1,000 selected cases, we have to bear in mind that as they were specially selected because they had been at least a year under observation, no mortality could appear in tables formed from Williams' data for the first year of observation, and we must also remember that his durations are reckoned from date of onset, not from date of treatment. This means that if onset was, on the average, a year before treatment, the expected mortality for the first two years must be left out of account.

Williams shows that out of the 1,000 cases 198 died, in 34 the lungs were healthy at the close of the investigation, in 280 the condition was improved, in 102 it was about the same, in 321 worse, and in 65 the condition of the lungs was unknown. In about two-thirds of the cases there was "consolidation" of the lungs, and in the other one-third either "softening" or "excavation", while in about one-third of the cases both lungs were affected.

Table VIII shows the result of our investigation, and it will be observed that we have not inserted any expected deaths for the first year (0-1), but have given a full year's risk for the second year, so that the table understates the mortality.

TABLE VIII

WILLIAMS' STATISTICS.

Total No. of Cases, 1,000.

Years since Onset of Disease.	No. of Cases living at Close of Observations.	Deaths.	Exposed to Risk.	Expected No. of Deaths.
0- 1	—	—	1,000	—
1- 2	71	8	964.5	6.1
2- 3	97	22	872.5	5.8
3- 4	96	18	754	5.3
4- 5	68	23	654	4.9
5- 9	224	75	2,273*	19.9
10-14	124	31	1,114*	12.4
15-19	54	12	551*	7.8
20 and over	68	9	299.5	5.5
Total	802	198	8,482.5	67.7

In order to compare this table with those already discussed we must make allowance for the time from onset to treatment, and if, as suggested above, this time is taken as one year, the expected number of deaths would be reduced to 61.6, while if it was two years (surely an ample allowance) the expected number would be 55.8, or rather more than one-fourth of the actual number. As Williams observed the cases for at least a year, it is probable that there were not very many far advanced cases included in his tables, so that we ought to compare his result with Bardswell's for the two groups "incipient" and "moderately advanced" taken together.

In order to facilitate a comparison Table IX has been prepared. It shows the relation of actual to expected deaths, so that if the actual number was 100 and the expected 20 the figure entered would be 5.

This table shows no appreciable improvement in the mortality of the tuberculous, but on the one hand it must be borne in mind that

- (1) we may have underestimated the time from onset to treatment in Williams' cases (though we do not think it likely that this exceeded two years on the average).
- (2) Williams and Pollock may have had a larger proportion of incipient cases; and on the other hand,
 - (1) the general mortality has improved, so that the comparison with the modern English Life Table (No. 6) is rather more severe on the older statistics;

* Estimated. Williams gives only the figures for living and dead in groups. Two methods were tried in our estimate, and the results were practically identical.

- (2) diagnosis has, we understand, improved, so that the disease can now be detected at an earlier stage; if this be true, treatment may be taking credit for what is due to diagnosis. Or, in other words, it is possible that treatment, owing to better diagnosis, takes credit for some cures that nature formerly effected unaided.

TABLE IX

Name of Observer.	Ratio of actual Deaths to the Number ex- pected by English Life Table (No. 6).
IN SANATORIUM DAYS.	
<i>Bardswell</i> : (1). Incipient	4.1
(2). Moderately advanced	7.8
(3). Far advanced	37.5
(4). (1) + (2)	6.2
(5). (1) + (2) + (3)	13.1
(6). Apparently cured	2.0
(7). Arrested	4.4
(8). Active	27.7
(9). (6) + (7) + (8)	12.0
<i>Brown and Pope</i> :	
(1). Apparently cured	3.0
(2). Arrested	13.1
(3). Active	39.5
(4). (1) + (2) + (3)	15.9
<i>Rumpf</i> :	
(1). Stage I	from 1.7 to 2
(2). Stage II	from 4.5 to 5
(3). Stage III	from 15 to 30
(4). (1) + (2) + (3)	from 8 to 13
IN PRE-SANATORIUM DAYS.*	
<i>Pollock</i> :	
(1). All cases from "onset"	1.8
(2). All cases neglecting durations over a year	5.4
<i>Williams</i> :	
(1). All cases from "onset"	2.9
(2). All cases assuming one year from onset to treatment	3.3
(3). All cases assuming two years from onset to treatment	3.6

It seems probable that Williams sent some of his cases to winter abroad in high altitudes, but it is impossible to tell whether these cases, by having a low mortality, reduced the mortality among Williams' cases taken as a whole.

Besides this, Bardswell observed comparatively few cases, and with larger numbers we might find that paucity of data had made the treatment appear less favourable than it really is, although we are bound to add that Rumpf's statistics show little better results than Bardswell's.

* The reader should bear in mind that Pollock's cases are principally drawn from the working classes and Williams' from the professional classes.

VII. *Summary and Conclusions.*

We may summarize our results as follows :—

- (1) The mortality of tuberculous patients who are undergoing or have undergone treatment is much heavier than that of the general population, and even when the disease is taken in an incipient stage the mortality is about four times as heavy.
- (2) The mortality of the apparently cured cases is about twice as heavy as that of the general population.
- (3) The mortality among sanatorium patients does not show any improvement on that of Williams' and Pollock's cases. The comparison is, however, rendered difficult by the way the older figures were given.

We confess that these conclusions are not those we hoped to reach. It would have been far more pleasant to record that the whole-hearted energy of those members of the medical profession who have devoted themselves to sanatorium treatment had succeeded in reducing the mortality among the tuberculous, but we cannot go beyond our statistics nor read into them opinions they do not justify.

We hope, however, that our medical friends will enable us to carry our investigations further, and will let us have information about the after-histories of their patients. Cards like those described in this paper will be supplied, and if these are properly filled up for *all* the cases treated the only other information required will be a general statement as to the methods adopted in deciding whether the patients had tuberculosis. We make this appeal for information because we wish to help, so far as possible, those engaged in the study of tuberculosis ; we feel sure that they would be the first to say that if there is the slightest doubt about the efficacy of the treatment the more thorough the investigation the better, and they would probably add that, as we are now hearing much about a " crusade " against consumption, it is well to be quite certain of our ground before incurring the expense of work and money that such a crusade entails.

NOTE.—Since this paper was written some further particulars of the mortality of the tuberculous after sanatorium treatment have reached us. It does not appear from a rough preliminary investigation that the data indicate that we have overestimated the mortality of the tuberculous after that treatment. We hope, however, to be able to deal fully with these and other particulars that may be available later in a further memoir on this subject.

APPENDIX OF DATA PROVIDED BY
DR. NOEL BARDSWELL, WITH ACTUARIAL REDUCTION

TABLES X TO XLVII

INCIPIENT CASES

TABLE X. AGE GROUP—UNDER 23 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 9.					Total No. Admitted, 4.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	4.5	.020	—	—	—	2	.008
1	—	—	—	9	.042	—	—	—	4	.017
2	—	—	—	9	.045	—	—	1	4	.017
3	1	—	—	8.5	.044	—	—	—	3	.014
4	—	—	—	8	.043	—	—	—	3	.014
5	—	1	1	7	.039	1	1	—	1.5	.007
6	—	3	—	3	.017	—	1	—	—	—
7	—	1	—	2	.012	—	—	—	—	—
8	—	1	—	1	.006	—	—	—	—	—
9	—	1	—	—	—	—	—	—	—	—
Total	1	7	1	52	.268	1	2	1	17.5	.077

TABLE XI. AGE GROUP—23-27 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 10.					Total No. Admitted, 6.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	1	—	—	4.5	.025	—	—	—	3	.015
1	—	—	1	9	.052	—	—	—	6	.031
2	—	—	—	8	.048	—	—	—	6	.032
3	—	—	—	8	.049	—	—	—	6	.033
4	—	—	—	8	.050	—	—	—	6	.035
5	—	1	1	7	.046	—	2	1	4	.024
6	—	1	1	5	.034	—	1	—	2	.013
7	—	3	1	1	.007	—	—	—	2	.013
8	—	—	—	—	—	—	2	—	—	—
Total	1	5	4	50.5	.311	—	5	1	35	.196

TABLE XII. AGE GROUP—28-32 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 7.					Total No. Admitted, 4.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	3.5	.023	—	—	—	2	.012
1	—	—	—	7	.048	—	—	—	4	.025
2	—	—	—	7	.051	—	—	—	4	.026
3	—	—	—	7	.054	—	—	—	4	.028
4	—	—	—	7	.058	—	—	—	4	.029
5	—	2	1	5	.044	—	2	—	2	.015
6	—	2	—	2	.018	—	2	—	—	—
7	—	1	—	1	.010	—	—	—	—	—
8	—	1	—	—	—	—	—	—	—	—
Total	—	6	1	39.5	.306	—	4	—	20	.135

INCIPIENT CASES (*continued*).

TABLE XIII. AGE GROUP—33-37 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 7.					Total No. Admitted, 6.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	1	—	—	3	.026	—	—	—	3	.023
1	—	—	1	6	.055	—	—	1	6	.048
2	—	—	—	5	.049	—	—	—	5	.042
3	—	—	—	5	.052	—	—	—	5	.045
4	—	—	—	5	.055	—	1	—	4	.037
5	—	—	—	5	.058	—	1	—	3	.029
6	—	—	—	5	.061	—	1	—	2	.020
7	—	2	—	3	.038	—	1	—	1	.010
8	—	3	—	—	—	—	1	—	—	—
Total	1	5	1	37	.394	—	5	1	29	.254

TABLE XIV. AGE GROUP—38-42 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 3.					Total No. Admitted, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	1.5	.017	—	—	—	.5	.005
1	—	—	—	3	.037	—	—	—	1	.010
2	—	—	—	3	.038	—	—	—	1	.010
3	—	—	—	3	.040	—	—	—	1	.011
4	—	—	1	3	.041	—	—	—	1	.011
5	—	1	—	1	.014	—	—	—	1	.011
6	—	—	—	1	.015	—	1	—	—	—
7	—	—	—	1	.016	—	—	—	—	—
8	—	1	—	—	—	—	—	—	—	—
Total	—	2	1	16.5	.218	—	1	—	5.5	.058

TABLE XV. AGE GROUP—OVER 43 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 4.					Total No. Admitted, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	2	.030	—	—	—	.5	.006
1	—	—	—	4	.064	—	—	—	1	.013
2	—	—	—	4	.068	—	—	—	1	.013
3	—	—	—	4	.072	—	—	—	1	.014
4	—	—	—	4	.075	—	—	—	1	.015
5	—	1	—	3	.060	—	—	—	1	.015
6	—	2	—	1	.021	—	—	—	1	.016
7	—	1	—	—	—	—	1	—	—	—
Total	—	4	—	22	.390	—	1	—	6.5	.092

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MODERATELY ADVANCED CASES.

TABLE XVI. AGE GROUP—UNDER 23 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 10.					Total No. Admitted, 5.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	5	·022	—	—	1	2·5	·010
1	—	—	2	10	·047	—	—	—	4	·016
2	—	—	1	8	·040	—	—	1	4	·016
3	—	—	—	7	·036	—	—	—	3	·013
4	—	1	1	6	·032	—	—	1	3	·013
5	—	2	—	3	·017	—	—	—	2	·009
6	—	1	1	2	·011	—	—	—	2	·009
7	—	—	—	1	·006	—	—	—	2	·010
8	—	—	—	1	·006	—	2	—	—	—
9	—	1	—	—	—	—	—	—	—	—
Total	—	5	5	43	·217	—	2	3	22·5	·096

TABLE XVII. AGE GROUP—23-27 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 15.					Total No. Admitted, 4.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	1	—	—	7	·039	—	—	—	2	·010
1	—	—	1	14	·081	—	—	1	4	·021
2	—	—	—	13	·077	—	—	1	3	·016
3	—	—	2	13	·079	—	—	—	2	·011
4	—	—	—	11	·069	—	—	—	2	·012
5	—	2	—	9	·059	—	—	1	2	·012
6	—	—	—	9	·062	—	—	—	1	·006
7	—	1	1	8	·058	—	1	—	—	—
8	—	6	—	1	·008	—	—	—	—	—
9	—	1	—	—	—	—	—	—	—	—
Total	1	10	4	85	·532	—	1	3	16	·088

TABLE XVIII. AGE GROUP—28-32 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 12.					Total No. Admitted, 5.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	6	·039	—	—	—	2·5	·016
1	—	—	2	12	·082	—	—	1	5	·033
2	—	—	2	10	·073	—	—	—	4	·028
3	1	—	—	7·5	·058	—	—	—	4	·029
4	—	—	—	7	·057	—	1	1	3	·023
5	—	3	1	4	·035	—	—	1	2	·016
6	—	—	—	3	·028	—	1	—	—	—
7	—	2	—	1	·010	—	—	—	—	—
8	—	1	—	—	—	—	—	—	—	—
Total	1	6	5	50·5	·382	—	2	3	20·5	·145

MODERATELY ADVANCED CASES (*continued*).

TABLE XIX. AGE GROUP—33-37 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 14.					Total No. Admitted, 8.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	1	7	.061	—	—	—	4	.031
1	—	—	—	13	.120	—	—	—	8	.064
2	—	—	1	13	.128	—	—	—	8	.068
3	—	—	1	12	.125	—	—	—	8	.071
4	—	—	—	11	.121	—	—	—	8	.075
5	—	4	—	7	.081	—	2	1	6	.059
6	—	2	—	5	.061	—	2	—	3	.030
7	—	2	—	3	.038	—	3	—	—	—
8	—	3	—	—	—	—	—	—	—	—
Total	—	11	3	71	.735	—	7	1	45	.398

TABLE XX. AGE GROUP—38-42 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 8.					Total No. Admitted, 2.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	4	.046	—	—	—	1	.010
1	—	—	1	8	.097	—	—	—	2	.020
2	—	—	2	7	.089	—	—	—	2	.021
3	—	—	—	5	.066	—	—	—	2	.021
4	—	—	—	5	.069	—	—	—	2	.022
5	—	1	—	4	.058	—	1	—	1	.011
6	—	—	—	4	.061	—	—	—	1	.012
7	—	2	—	2	.032	—	—	—	1	.013
8	—	1	—	1	.017	—	1	—	—	—
9	—	1	—	—	—	—	—	—	—	—
Total	—	5	3	40	.535	—	2	—	12	.130

TABLE XXI. AGE GROUP—OVER 43 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 10.					Total No. Admitted, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	5	.094	—	—	—	.5	.008
1	—	—	2	10	.199	—	—	—	1	.016
2	—	—	1	8	.168	—	—	—	1	.017
3	—	—	—	7	.155	—	—	—	1	.018
4	—	—	—	7	.164	—	—	—	1	.020
5	—	1	—	6	.149	—	—	—	1	.021
6	—	3	1	3	.080	—	1	—	—	—
7	1	1	—	.5	.014	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—
Total	1	5	4	46.5	1.023	—	1	—	5.5	.100

MORTALITY OF TUBERCULOUS AND SANATORIUM TREATMENT 27

FAR ADVANCED CASES.

TABLE XXII. AGE GROUP—UNDER 23 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 9.					Total No. Admitted, 16.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	5	4.5	.020	—	—	6	8	.033
1	—	—	1	4	.019	—	—	4	10	.042
2	—	—	1	3	.015	—	—	2	6	.026
3	—	—	2	2	.010	—	—	1	4	.018
4	—	—	—	—	—	—	—	—	3	.014
5	—	—	—	—	—	—	1	—	2	.010
6	—	—	—	—	—	—	—	2	2	.010
Total	—	—	9	13.5	.064	—	1	15	35	.153

TABLE XXIII. AGE GROUP—23-27 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 10.					Total No. Admitted, 5.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	4	5	.028	—	—	—	2.5	.012
1	—	—	5	6	.035	—	—	1	5	.026
2	—	—	1	1	.006	—	—	1	4	.021
3	—	—	—	—	—	—	—	—	3	.017
4	—	—	—	—	—	—	—	—	3	.017
5	—	—	—	—	—	—	—	—	3	.018
6	—	—	—	—	—	—	1	1	2	.013
7	—	—	—	—	—	—	—	—	1	.007
8	—	—	—	—	—	—	1	—	—	—
Total	—	—	10	12	.069	—	2	3	23.5	.131

TABLE XXIV. AGE GROUP—28-32 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 5.					Total No. Admitted, 10.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	2.5	.016	—	—	—	5	.030
1	—	—	3	5	.034	—	—	3	10	.063
2	—	—	—	2	.014	—	—	2	7	.046
3	—	—	1	2	.015	—	—	—	5	.035
4	—	—	—	1	.008	—	—	3	5	.036
5	—	—	—	1	.009	—	—	—	2	.015
6	—	—	—	1	.009	—	—	—	2	.016
7	—	—	—	1	.010	—	—	—	2	.017
8	—	—	1	1	.010	—	2	—	—	—
Total	—	—	5	16.5	.125	—	2	8	38	.258

FAR ADVANCED CASES (*continued*).

TABLE XXV. AGE GROUP—33-37 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 9.					Total No. Admitted, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	1	4.5	.039	—	—	—	.5	.004
1	—	—	3	8	.074	—	—	1	1	.008
2	—	—	—	5	.049	—	—	—	—	—
3	—	—	2	5	.052	—	—	—	—	—
4	—	—	—	3	.033	—	—	—	—	—
5	—	1	1	2	.023	—	—	—	—	—
6	—	—	—	1	.012	—	—	—	—	—
7	—	1	—	—	—	—	—	—	—	—
Total	—	2	7	28.5	.282	—	—	1	1.5	.012

TABLE XXVI. AGE GROUP—38-42 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 9.					Total No. Admitted, 2.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	2	4.5	.052	—	—	—	1	.010
1	—	—	3	7	.085	—	—	1	2	.020
2	—	—	2	4	.051	—	—	—	1	.010
3	—	—	—	2	.026	—	—	—	1	.011
4	—	—	1	2	.028	—	—	—	1	.011
5	—	—	—	1	.014	—	1	—	—	—
6	—	—	—	1	.015	—	—	—	—	—
7	—	—	—	1	.016	—	—	—	—	—
8	—	1	—	—	—	—	—	—	—	—
Total	—	1	8	22.5	.287	—	1	1	6	.062

TABLE XXVII. AGE GROUP—OVER 43 AT ADMISSION.

No. of years since Admission.	Males.					Females.				
	Total No. Admitted, 7.					Total No. Admitted, 2.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	2	3.5	.066	—	—	—	1	.017
1	—	—	2	5	.099	—	—	—	2	.037
2	—	—	2	3	.063	—	—	—	2	.039
3	—	—	—	1	.022	—	—	—	2	.042
4	—	—	—	1	.023	—	—	—	2	.045
5	—	—	1	1	.025	—	—	—	2	.049
6	—	—	—	—	—	—	1	1	1	.026
Total	—	—	7	14.5	.298	—	1	1	12	.255

MORTALITY OF TUBERCULOUS AND SANATORIUM TREATMENT 29

TABLE XXVIII. SHOWING THE MORTALITY OF ALL PEOPLE UNDERGOING SANATORIUM TREATMENT ACCORDING TO AGE AND REGARDLESS OF TIME ELAPSED SINCE ADMISSION.

Age last Birth-day.	Males.						Females.					
	Admitted.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Admitted.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
11	1	—	—	—	.5	.00	—	—	—	—	—	—
12	—	—	—	—	1	.00	—	—	—	—	—	—
13	—	—	—	—	1	.00	—	—	—	—	—	—
14	—	—	—	—	1	.00	—	—	—	—	—	—
15	2	—	—	1	2	.01	1	—	—	1	.5	.00
16	—	—	—	1	2	.01	1	—	—	—	.5	.00
17	1	—	1	—	.5	.00	1	—	—	—	1.5	.01
18	2	—	—	2	2	.01	3	—	—	2	3.5	.01
19	5	—	—	—	3.5	.01	2	—	—	2	4	.02
20	6	—	—	1	9	.04	7	—	—	2	6.5	.03
21	5	—	—	1	13.5	.06	7	—	—	2	11.5	.05
22	6	—	—	2	18	.09	3	—	—	3	14.5	.06
23	5	1	—	4	21	.11	3	—	1	4	13.5	.06
24	8	1	2	2	20.5	.11	3	—	1	2	11.5	.05
25	8	—	1	3	25	.14	4	1	—	1	12.5	.06
26	3	1	—	2	27	.16	2	—	1	1	13	.07
27	11	—	4	4	27.5	.16	3	—	1	2	13.5	.07
28	7	—	4	4	28.5	.17	2	—	1	1	13	.07
29	4	—	—	5	30	.19	1	—	2	—	11.5	.07
30	6	—	1	2	29	.19	11	—	—	2	17.5	.11
31	3	—	5	1	26.5	.18	4	—	2	4	21	.13
32	4	—	5	2	24	.16	1	—	1	3	18.5	.12
33	5	—	7	3	19.5	.15	3	—	1	1	16.5	.11
34	7	1	1	3	21	.17	4	—	2	1	17	.12
35	10	—	4	3	22	.19	4	—	4	5	16	.12
36	3	—	—	3	25.5	.24	4	—	1	—	14	.11
37	5	1	1	2	25	.25	—	—	1	—	15	.13
38	4	—	2	2	25	.26	—	—	1	1	14	.12
39	1	—	5	1	20.5	.23	1	—	3	—	10.5	.10
40	9	—	1	3	23.5	.27	4	—	2	—	11	.11
41	1	—	4	3	21.5	.26	—	—	4	1	9	.09
42	5	—	3	6	18.5	.23	—	—	3	—	5	.05
43	—	—	3	1	12	.16	—	—	1	—	4	.04
44	3	—	3	—	9.5	.13	—	—	1	—	3	.03
45	5	—	2	2	11.5	.17	1	—	1	—	2.5	.03
46	—	—	—	1	12	.18	—	—	1	—	2	.02
47	3	—	1	1	11.5	.18	—	—	—	—	2	.03
48	2	—	1	1	12	.20	—	—	1	—	1	.01
49	—	—	2	—	10	.18	—	—	—	—	1	.01
50	4	—	3	—	9	.17	1	—	—	—	1.5	.02
51	—	1	1	1	9.5	.19	—	—	—	—	2	.03
52	—	—	3	2	5	.10	1	—	1	—	1.5	.02
53	1	—	—	—	3.5	.08	—	—	—	—	2	.03
54	1	—	2	—	2.5	.06	1	—	—	—	2.5	.05
55	—	—	—	—	3	.07	—	—	—	—	3	.06
56	—	—	1	—	2	.05	—	—	1	—	2	.04
57	—	—	—	—	2	.06	—	—	—	—	2	.04
58	—	—	—	—	2	.06	—	—	1	—	1	.02
59	—	—	—	—	2	.07	—	—	—	—	1	.03
60	—	—	1	1	1	.03	—	—	—	1	1	.03
61	1	—	—	1	.5	.02	—	—	—	—	—	—
62	1	—	—	—	1	.04	—	—	—	—	—	—
63	—	—	—	—	1	.04	—	—	—	—	—	—
64	—	—	—	—	1	.04	—	—	—	—	—	—
65	—	—	—	—	1	.05	—	—	—	—	—	—
66	—	—	—	—	1	.05	—	—	—	—	—	—
67	—	—	—	1	1	.06	—	—	—	—	—	—
Total	158	6	74	78	661.5	6.49	83	1	40	42	351	2.59

APPARENTLY CURED CASES.

TABLE XXIX. AGE GROUP—UNDER 23 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 5.					Total No. Discharged, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	2.5	.011	—	—	—	.5	.002
1	—	—	—	5	.024	—	—	—	1	.004
2	1	—	—	4.5	.022	—	—	—	1	.004
3	—	—	—	4	.021	—	—	—	1	.005
4	—	1	—	3	.016	—	—	—	1	.005
5	—	—	—	3	.017	—	—	—	1	.005
6	—	2	—	1	.006	—	—	—	1	.005
7	—	—	—	1	.006	—	—	—	1	.005
8	—	1	—	—	—	—	1	—	—	—
Total	1	4	—	24	.123	—	1	—	7.5	.035

TABLE XXX. AGE GROUP—23-27 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 6.					Total No. Discharged, 5.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	1	—	—	2.5	.014	—	—	—	2.5	.012
1	—	—	—	5	.029	—	—	—	5	.026
2	—	—	—	5	.030	—	—	—	5	.027
3	—	—	—	5	.031	—	—	—	5	.028
4	—	—	1	5	.032	—	1	—	4	.023
5	—	1	—	3	.020	—	1	1	3	.018
6	—	2	—	1	.007	—	1	—	1	.006
7	—	—	1	1	.007	—	—	—	1	.007
8	—	—	—	—	—	—	1	—	—	—
Total	1	3	2	27.5	.170	—	4	1	26.5	.147

TABLE XXXI. AGE GROUP—28-32 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 5.					Total No. Discharged, 4.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	2.5	.016	—	—	—	2	.012
1	—	—	—	5	.034	—	—	—	4	.025
2	—	—	—	5	.036	—	—	—	4	.027
3	—	—	—	5	.039	—	—	—	4	.028
4	—	—	—	5	.041	—	1	—	3	.022
5	—	1	1	4	.035	—	1	—	2	.015
6	—	2	—	1	.009	—	1	—	1	.008
7	—	1	—	—	—	—	1	—	—	—
8	—	—	—	—	—	—	—	—	—	—
Total	—	4	1	27.5	.210	—	4	—	20	.137

MORTALITY OF TUBERCULOUS AND SANATORIUM TREATMENT 31

APPARENTLY CURED CASES (*continued*).

TABLE XXXII. AGE GROUP—33-37 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 8.					Total No. Discharged, 2.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	4	·035	—	—	—	1	·008
1	—	—	—	8	·074	—	—	—	2	·016
2	—	—	—	8	·079	—	—	—	2	·017
3	—	—	—	8	·083	—	—	—	2	·018
4	—	—	—	8	·088	—	—	—	2	·019
5	—	2	—	6	·070	—	—	—	2	·020
6	—	1	—	5	·061	—	—	—	2	·020
7	—	2	—	3	·038	—	2	—	—	—
8	—	3	—	—	—	—	—	—	—	—
Total	—	8	—	50	·528	—	2	—	13	·118

TABLE XXXIII. AGE GROUP—38-42 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 1.					Total No. Discharged, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	·5	·006	—	—	—	·5	·005
1	—	—	—	1	·012	—	—	—	1	·010
2	—	—	—	1	·013	—	—	—	1	·010
3	—	—	1	1	·013	—	—	—	1	·011
4	—	—	—	—	—	—	—	—	1	·011
5	—	—	—	—	—	—	1	—	—	—
Total	—	—	1	3·5	·044	—	1	—	4·5	·047

TABLE XXXIV. AGE GROUP—OVER 43 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 7.					Total No. Discharged, 1.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	3·5	·066	—	—	—	·5	·007
1	—	—	—	7	·139	—	—	—	1	·015
2	—	—	—	7	·147	—	—	—	1	·016
3	—	—	—	7	·155	—	—	—	1	·017
4	—	—	—	7	·164	—	—	—	1	·018
5	—	2	—	5	·125	—	—	—	1	·020
6	—	3	—	2	·053	—	—	—	1	·021
7	—	2	—	—	—	—	1	—	—	—
Total	—	7	—	38·5	·849	—	1	—	6·5	·114

ARRESTED CASES.

TABLE XXXV. AGE GROUP—UNDER 23 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 7.					Total No. Discharged, 3.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	3.5	.016	—	—	—	1.5	.006
1	—	—	—	7	.033	—	—	—	3	.013
2	—	—	—	7	.035	—	—	—	3	.013
3	—	—	—	7	.036	—	—	1	3	.014
4	—	1	—	6	.032	—	—	—	2	.009
5	—	1	—	5	.028	—	1	—	1	.005
6	—	1	1	4	.023	—	1	—	—	—
7	—	1	—	2	.012	—	—	—	—	—
8	—	2	—	—	—	—	—	—	—	—
Total	—	6	1	41.5	.215	—	2	1	13.5	.060

TABLE XXXVI. AGE GROUP—23-27 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 18.					Total No. Discharged, 2.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	9	.050	—	—	—	1	.005
1	—	—	1	18	.104	—	—	—	2	.010
2	—	—	2	17	.101	—	—	—	2	.011
3	—	—	—	15	.092	—	—	—	2	.011
4	—	1	1	14	.088	—	—	—	2	.012
5	—	3	—	10	.066	—	—	—	2	.012
6	—	1	—	9	.062	—	—	—	2	.013
7	—	4	—	5	.036	—	1	—	1	.007
8	—	5	—	—	—	—	1	—	—	—
Total	—	14	4	97	.599	—	2	—	14	.081

TABLE XXXVII. AGE GROUP—28-32 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 10.					Total No. Discharged, 3.				
	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investiga- tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	5	.033	—	—	—	1.5	.009
1	—	—	1	10	.068	—	—	—	3	.019
2	—	—	—	9	.066	—	—	—	3	.020
3	—	—	—	9	.070	—	—	—	3	.021
4	—	—	—	9	.074	—	—	—	3	.022
5	—	4	—	5	.044	—	1	1	2	.015
6	—	1	1	4	.037	—	1	—	—	—
7	—	2	1	1	.010	—	—	—	—	—
Total	—	7	3	52	.402	—	2	1	15.5	.106

MORTALITY OF TUBERCULOUS AND SANATORIUM TREATMENT 33

ARRESTED CASES (*continued*).

TABLE XXXVIII. AGE GROUP—33-37 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 8.					Total No. Discharged, 7.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	1	—	—	3·5	·031	—	—	—	3·5	·027
1	—	—	2	7	·065	—	—	1	7	·058
2	—	—	—	5	·049	—	—	—	6	·051
3	—	—	—	5	·052	—	—	—	6	·054
4	—	1	—	4	·044	—	1	—	5	·047
5	—	1	—	3	·035	—	2	—	3	·029
6	—	1	—	2	·024	—	2	—	1	·010
7	—	2	—	—	—	—	1	—	—	—
Total	1	5	2	29·5	·300	—	6	1	31·5	·276

TABLE XXXIX. AGE GROUP—38-42 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 6.					Total No. Discharged, 1.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	3	·035	—	—	—	·5	·005
1	—	—	—	6	·073	—	—	—	1	·010
2	—	—	—	6	·076	—	—	—	1	·010
3	—	—	—	6	·079	—	—	—	1	·011
4	—	—	—	6	·083	—	—	—	1	·011
5	—	2	—	4	·058	—	—	—	1	·011
6	—	—	—	4	·061	—	—	—	—	—
7	—	2	—	2	·032	—	1	—	—	—
8	—	2	—	—	—	—	—	—	—	—
Total	—	6	—	37	·497	—	1	—	5·5	·058

TABLE XL. AGE GROUP—OVER 43 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 3.					Total No. Discharged, —.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	—	1·5	·028	—	—	—	—	—
1	—	—	—	3	·060	—	—	—	—	—
2	—	—	—	3	·063	—	—	—	—	—
3	—	—	—	3	·066	—	—	—	—	—
4	—	—	—	3	·070	—	—	—	—	—
5	—	1	—	2	·050	—	—	—	—	—
6	—	2	—	—	—	—	—	—	—	—
Total	—	3	—	15·5	·337	—	—	—	—	—

ACTIVE CASES.

TABLE XLI. AGE GROUP—UNDER 23 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 9.					Total No. Discharged, 15.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	4	4.5	.020	—	—	5	7.5	.031
1	—	—	3	5	.024	—	—	2	10	.042
2	—	—	1	2	.010	—	—	3	8	.035
3	—	—	1	1	.005	—	—	1	5	.023
4	—	—	—	—	—	—	—	—	4	.019
5	—	—	—	—	—	1	1	—	2.5	.012
6	—	—	—	—	—	—	—	1	2	.010
7	—	—	—	—	—	—	—	—	1	.005
8	—	—	—	—	—	—	1	—	—	—
Total	—	—	9	12.5	.059	1	2	12	40	.177

TABLE XLII. AGE GROUP—23-27 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 7.					Total No. Discharged, 8.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	1	—	2	3	.017	—	—	2	4	.020
1	—	—	2	4	.023	—	—	1	6	.031
2	—	—	1	2	.012	—	—	1	5	.027
3	—	—	—	1	.006	—	—	—	4	.022
4	—	—	—	1	.006	—	—	—	4	.023
5	—	—	—	1	.007	—	—	2	4	.024
6	—	—	1	1	.007	—	1	1	1	.006
Total	1	—	6	13	.078	—	1	7	28	.153

TABLE XLIII. AGE GROUP—28-32 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 10.					Total No. Discharged, 13.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	1	5	.033	—	—	1	6.5	.039
1	—	—	5	9	.062	—	—	4	12	.076
2	—	—	1	4	.029	—	—	1	8	.053
3	1	—	—	2.5	.019	—	—	3	7	.049
4	—	—	1	2	.016	—	1	1	3	.022
5	—	—	—	1	.009	—	—	—	2	.015
6	—	1	—	—	—	—	—	—	2	.016
7	—	—	—	—	—	—	—	—	2	.017
8	—	—	—	—	—	—	2	—	—	—
Total	1	1	8	23.5	.168	—	3	10	42.5	.287

MORTALITY OF TUBERCULOUS AND SANATORIUM TREATMENT 35

ACTIVE CASES (continued).

TABLE XLIV. AGE GROUP—33-37 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 14.					Total No. Discharged, 6.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	2	7	.061	—	—	1	3	.023
1	—	—	2	12	.111	—	—	—	5	.040
2	—	—	3	10	.098	—	—	—	5	.042
3	—	—	1	7	.073	—	—	—	5	.045
4	—	—	1	6	.066	—	—	—	5	.047
5	—	2	—	3	.035	—	1	1	4	.039
6	—	—	—	3	.037	—	3	—	—	—
7	—	3	—	—	—	—	—	—	—	—
Total	—	5	9	48	.481	—	4	2	27	.236

TABLE XLV. AGE GROUP—38-42 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 10.					Total No. Discharged, 3.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	1	5	.058	—	—	1	1.5	.015
1	—	—	3	9	.110	—	—	—	2	.020
2	—	—	4	6	.076	—	—	—	2	.021
3	—	—	—	2	.026	—	—	—	2	.021
4	—	—	1	2	.028	—	—	—	2	.022
5	—	—	—	1	.014	—	1	—	1	.011
6	—	—	—	1	.015	—	—	—	1	.012
7	—	1	—	—	—	—	—	—	1	.013
8	—	—	—	—	—	—	1	—	—	—
Total	—	1	9	26	.327	—	2	1	12.5	.135

TABLE XLVI. AGE GROUP—OVER 43 AT DISCHARGE.

No. of years since Discharge.	Males.					Females.				
	Total No. Discharged, 10.					Total No. Discharged, 3.				
	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.	Lost sight of.	Living at close of Investigation.	Died.	Exposed to Risk.	Expected No. of Deaths.
0	—	—	1	5	.094	—	—	—	1.5	.022
1	—	—	4	9	.179	—	—	—	3	.046
2	—	—	2	5	.105	—	—	—	3	.049
3	—	—	—	3	.066	—	—	—	3	.052
4	—	—	—	3	.070	—	—	—	3	.055
5	—	—	2	3	.075	—	—	—	3	.059
6	1	—	—	.5	.013	—	2	1	1	.021
Total	1	—	9	28.5	.602	—	2	1	17.5	.304

TABLE XLVII. SHOWING THE MORTALITY OF DISCHARGED PATIENTS WHO WERE DESCRIBED AS "APPARENTLY CURED" AND "DISEASE ARRESTED" WHEN DISCHARGED. TABLE ARRANGED ACCORDING TO AGE AND REGARDLESS OF TIME ELAPSED SINCE DISCHARGE.

Age last Birth-day.	Males.						Females.					
	Dis-charged.	Lost sight of.	Living at close of Investiga-tion.	Died.	Exposed to Risk.	Expected No. of Deaths.	Dis-charged.	Lost sight of.	Living at close of Investiga-tion.	Died.	Exposed to Risk.	Expected No. of Deaths.
11	1	—	—	—	.5	.00	—	—	—	—	—	—
12	—	—	—	—	1	.00	—	—	—	—	—	—
13	—	—	—	—	1	.00	—	—	—	—	—	—
14	—	—	—	—	1	.00	—	—	—	—	—	—
15	—	—	—	—	1	.00	—	—	—	—	—	—
16	—	—	—	—	1	.00	1	—	—	—	.5	.00
17	1	—	1	—	.5	.00	—	—	—	—	1	.00
18	—	—	—	—	1	.00	1	—	—	—	1.5	.01
19	2	—	—	—	2	.01	—	—	—	—	2	.01
20	4	—	—	—	5	.02	1	—	—	—	2.5	.01
21	3	—	—	—	8.5	.04	1	—	—	—	3.5	.01
22	1	—	—	—	10.5	.05	—	—	—	—	4	.02
23	6	1	—	1	13.5	.07	1	—	1	1	3.5	.02
24	3	1	2	—	14	.08	2	—	1	—	3	.01
25	9	—	1	1	18.5	.10	2	—	—	—	5	.02
26	2	—	—	—	23	.13	—	—	—	—	6	.03
27	4	—	4	1	22	.13	2	—	1	—	6	.03
28	4	—	4	—	21	.13	1	—	—	—	7.5	.04
29	3	—	—	3	24.5	.15	1	—	2	—	6.5	.04
30	1	—	1	1	22.5	.15	3	—	—	1	8.5	.05
31	5	—	5	—	19.5	.13	1	—	1	—	8.5	.05
32	2	—	5	1	18	.13	1	—	1	—	8.5	.06
33	3	—	7	—	12.5	.10	1	—	1	—	8.5	.06
34	3	—	1	2	14.5	.12	2	—	1	—	9	.07
35	3	—	3	—	12.5	.11	3	—	4	2	7.5	.06
36	4	—	—	1	16	.15	3	—	1	—	7.5	.06
37	3	1	1	1	17	.16	—	—	1	—	8	.07
38	—	—	2	1	15	.16	—	—	—	—	8	.07
39	1	—	4	—	10.5	.12	—	—	1	—	7	.07
40	3	—	—	—	12.5	.15	2	—	2	—	6	.06
41	1	—	4	—	10.5	.13	—	—	3	—	4	.04
42	2	—	2	1	10	.13	—	—	1	—	3	.03
43	1	—	2	—	8.5	.11	—	—	1	—	2	.02
44	1	—	2	—	7.5	.10	—	—	—	—	2	.02
45	2	—	2	—	7	.10	1	—	1	—	1.5	.02
46	—	—	—	—	8	.12	—	—	1	—	1	.01
47	2	—	1	—	8	.13	—	—	—	—	1	.01
48	1	—	—	—	9.5	.16	—	—	—	—	1	.01
49	1	—	2	—	8.5	.15	—	—	—	—	1	.01
50	1	—	3	—	6.5	.12	—	—	—	—	1	.02
51	—	—	1	—	6	.12	—	—	—	—	1	.02
52	—	—	3	—	3	.06	—	—	1	—	—	—
53	—	—	—	—	3	.07	—	—	—	—	—	—
54	1	—	2	—	1.5	.04	—	—	—	—	—	—
55	—	—	—	—	2	.05	—	—	—	—	—	—
56	—	—	1	—	1	.03	—	—	—	—	—	—
57	—	—	—	—	1	.03	—	—	—	—	—	—
58	—	—	—	—	1	.03	—	—	—	—	—	—
59	—	—	—	—	1	.03	—	—	—	—	—	—
60	—	—	1	—	—	—	—	—	—	—	—	—
Total	84	3	67	14	443.5	4.10	30	—	26	4	158	1.14

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